No. 787,392. PATENTED APR. 18, 1905.

H. McC. NORRIS.

VARIABLE SPEED MECHANISM.

APPLICATION FILED NOV. 21, 1904.

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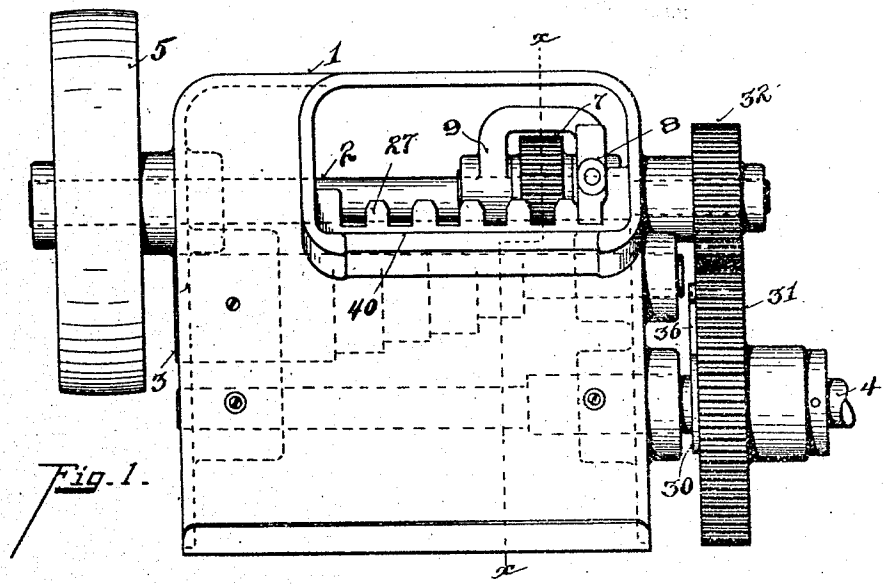


Fig. 1.

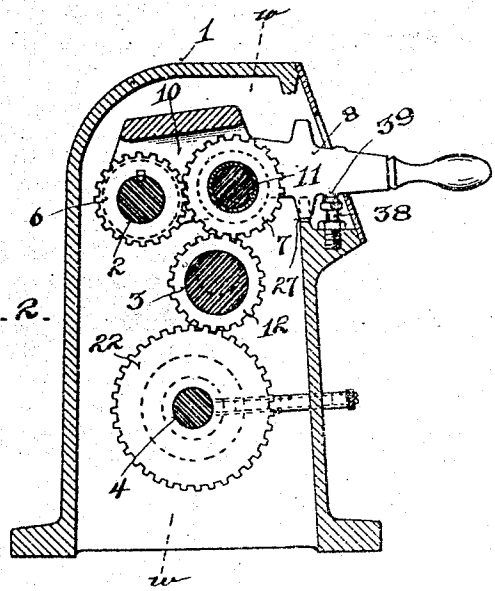


Fig. 2.

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Witnesses

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2 SHEETS—SHEET 2.

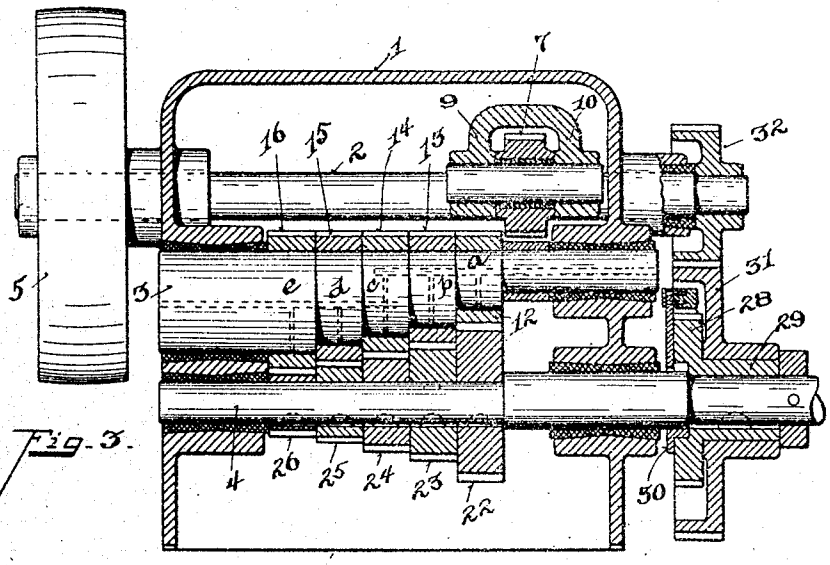


Fig. 3.

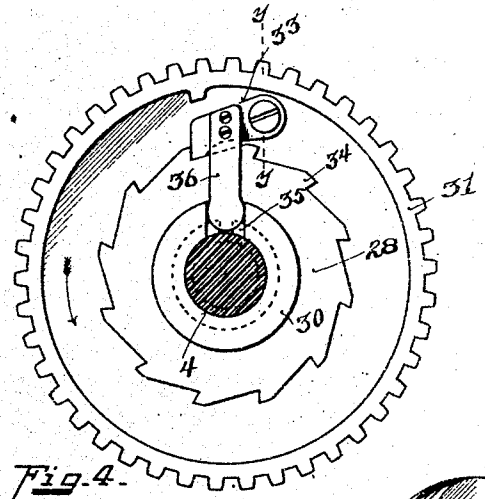


Fig. 4.

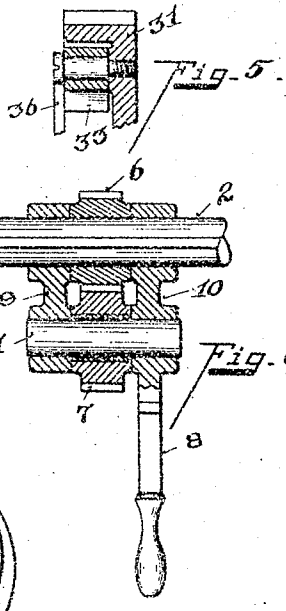


Fig. 5.

Fig. 6.

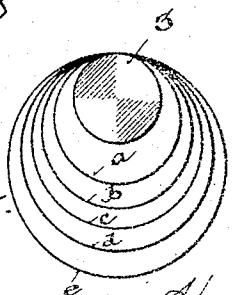


Fig. 7.

Witnesses

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No. 787,392. Patented April 18, 1905.

UNITED STATES PATENT OFFICE.

HENRY McCOY NORRIS, OF CINCINNATI, OHIO.

VARIABLE-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 787,392, dated April 18, 1905.

Application filed November 21, 1904. Serial No. 233,576.

To all whom it may concern:

Be it known that I, HENRY McCOY NORRIS, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Variable-Speed Mechanism, of which the following is a specification.

My invention relates to a variable-speed mechanism suitable for application to counter-shafts, machine-tools, or other machine organizations.

One of the objects of the invention is to control the speed-changing devices with a lever rocking and sliding on a shaft, the arrangement being such that the rocking movement of said lever for each of the several changes is restrained in kind and degree.

Another object of the invention is to provide an automatic speed-reducing mechanism for the purpose of enabling gear-wheels to be intermeshed with perfect safety while running.

Other features of the invention are more fully set forth in the description of the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a front elevation of my improved speed mechanism. Fig. 2 is a section on line *x x*, Fig. 1. Fig. 3 is a longitudinal section of the entire machine, taken on line *w w*, Fig. 2. Fig. 4 is an enlarged detailed view of gear-transmitter, showing the pawl-and-ratchet mechanism in plan. Fig. 5 is a section on line *y y*, Fig. 4. Fig. 6 is a detailed sectional view of the tumbler-shifting mechanism. Fig. 7 is an end elevation of the eccentric shaft.

1 represents the casing, in which are suitably journaled the driving-shaft 2, intermediate stud-shaft 3, and driven shaft 4.

5 represents the driving-wheel on shaft 2. Power may be taken in any suitable manner from shaft 4, or the arrangement may be reversed, 4 being the driving-shaft and 2 the driven shaft, the invention not being limited to the driving relation shown.

Upon shaft 2 is a pinion 6, adapted to turn with and slide on shaft 2.

7 represents an engaging gear-wheel intermeshed with pinion 6.

8 represents a tumbler-lever having the fork ends 9 10, between which the gears 6 7 are held, gear-wheel 7 being fixed on stud-shaft 11, which journals in bearings in the forked end of the lever 8. This constitutes what is ordinarily termed a "tumbler-lever," as it moves laterally on shaft 2 and rocks on shaft 2 as a center for bringing the gear-wheel 7 selectively and independently into mesh with a desired speed-changing gear on another shaft.

The shaft 3 has formed upon it a series of eccentric bearings *a b c d e*. These eccentrics are of different diameter and they extend in step-like arrangement downward, presenting a straight upper peripheral line.

12 13 14 15 16 are gear-wheels journaled, respectively, upon eccentric bearings *a b c d e*, respectively. The gear-wheels are of different diameter, and by means of these eccentric bearings the teeth are presented in a straight line under the gear-wheel 7 of the tumbler 8. These gears present their teeth in step-like arrangement opposite the shaft 4, and they are respectively intermeshed with a reverse step-like arrangement of gear-wheels 22 23 24 25 26, fixed upon shaft 4. The lever 8 projects through the casing, and the lower wall of the slot forms a straight line horizontally and is provided with the teeth 27, between which the lever 8 rests in its various positions. It is seen that by this arrangement the change can be made by lifting lever 8 sufficiently to clear the teeth 27 and shifting it to the desired position. As the tumbler 8 describes the same arc of movement for each speed change, it follows that the gear-wheel 7 is so presented to the gear-wheels on shaft 3 that the teeth are intermeshed at the same angle and with the same kind of a movement for each change. This is quite an improvement in the ease and convenience of making the change, also in the safety in making the change when the gear-wheels on shaft 3 are in motion, and this arrangement, further, has a merit of increasing the durability of the gear members.

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I have found it desirable to use some mechanism which will be automatically actuated when the tumbler is raised to cause the shaft 4 to slowly rotate, and thereby slowly rotating the gear-wheels on the shaft 3, so that the gear-wheel 7 may be safely intermeshed with a gear-wheel on shaft 3 while running. This mechanism must also be actuated by the speeding up of the shaft 4 when the tumbler is in engagement to throw the speed-reducing mechanism out of commission. For these purposes I have invented the following mechanism: Upon shaft 4 is fixed a ratchet-wheel 28, having a hub 29. (See Figs. 3 and 4.) The center of the ratchet-wheel 28 is bored to a greater diameter than the shaft 4 to provide for a collar 30 fitting within said bore and loose on shaft 4. Journaled upon the hub 29 of the ratchet-wheel 28 is a gear-wheel 31. 32 represents a relatively small diameter gear-wheel fixed on shaft 2 for driving the gear-wheel 31 at a relatively slow speed. Pivoted to the inside of the wheel 31 is a pawl 33, engaging with the teeth 34 of the ratchet-wheel 28. The collar 30 is provided with a diametrical slot 35. 36 represents a stem, one end of which is fixed to the pawl 33, and the other end engages into the slot 35 of the collar 30, there being a slight amount of tension, but not enough to prevent the movement of the stem 36 in and out in the slot 35.

The operation is as follows: When the tumbler-gear 7 is in driving engagement, the shaft 4 is speeded up, and as it carries the ratchet-wheel 28, keyed thereon, the ratchet-wheel revolves faster than the gear-wheel 32, loosely journaled thereon. Hence the teeth of the ratchet-wheel 28 lift the pawl out of engagement with the teeth. The direction of rotation is indicated by the arrow, Fig. 4. The shaft 4 has a tendency to carry with it in its rotation the loose collar 30, which tendency causes the right-hand wall of the slot 35 to bear against the right-hand end of the stem 36, thereby straining the stem away from the center on which the pawl is pivoted, and so holding the stem at the outer end of the slot with the pawl free from the ratchet-teeth. This prevents clicking and the useless wear of pawl and ratchet-teeth. When the tumbler is raised, the shaft 4 gradually slows down until it approximates the slow speed of the gear-wheel 31. When the speed-shaft 4 is sufficiently reduced to release the tension between the collar 30 and the stem 35, the stem drops down in the slot, bringing the pawl into engagement with the ratchet-teeth 34, thereby fixing the gear 31 to the shaft 4 through the pawl-and-ratchet mechanism and slowly rotating the shaft, which obviously imparts a slow rotation to the gear-wheels on shaft 3, making it easy and safe to engage the gear-wheel 7 of the tumbler with a selected gear-wheel on shaft 3. It seems obvious that if the shaft 4 be rotated more slowly than the gear-wheel 31 the left-hand edge of the stem 36 will be pushed against the left-hand wall of the slot 35, thereby straining the stem toward the center, on which the pawl is pivoted, which action will force the stem to the inner extremity of the slot 35, bringing the pawl into engagement with the ratchet-wheel.

The device works as indicated—that is, when the tumbler is engaged the shaft 4 rotates rapidly relatively and the pawl and ratchet are disengaged, throwing the speed-reducing mechanism out of commission, gear-wheels 31 and 32 turning idly. When the tumbler is raised and the shaft 4 has slowed down, the pawl-and-ratchet mechanism automatically engage and the shaft 4 is slowly driven through the gear-wheels 31 32.

It will be noted that no lock mechanism is used or needed between the tumbler and casing. The tumbling-gear 7, lying between the fulcrum of the lever and the handle thereof, makes a weighted lever.

To provide for the requisite depth of intermesh between gear-wheel 7 and its intermeshing series of gears, I provide on the casing the adjustable set-screw 38, upon which rests the lug 39 in the lever-handle, there being a set-screw for each of the gear-wheels of the cone. This can be set to gage the intermesh correctly; but the tumbler-handle can be picked up with a very easy movement and simply dropped in its selected position of engagement, its position being at all times in a straight horizontal line defined by the bottom wall of the slot 40 in the casing.

Having described my invention, I claim—

1. In a variable-speed device, a tumbler-shaft, a tumbler-lever sliding and rocking thereon, a pinion and tumbler-gear carried by the tumbler-lever on said shaft, an intermediate shaft having a series of eccentric bearings of different diameter, the peripheries of said bearings being flush at a given point, different-diameter gear-wheels journaled on said eccentric bearings with their teeth flush under the tumbling-gear, a third shaft, and a series of gear-wheels of different diameter thereon intermeshed respectively with the different-diameter gear-wheels on the intermediate shaft, substantially as described.

2. In a variable-speed device, a tumbler-shaft, a tumbler-lever, a pinion and tumbling-gear carried by said lever and rocking and sliding on said shaft, a second shaft, different-diameter gear-wheels adapted to be engaged by the tumbler gear-wheel, an intermeshing set of different-diameter gear-wheels fixed on said second shaft, a relatively small gear-wheel on the tumbler-shaft, an intermeshing gear-wheel of larger diameter loose on the second shaft, pawl-and-ratchet mechanism for connecting said loose gear-wheel to the second

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shaft, and means actuated by the changes of speed of the second shaft to engage and disengage said pawl-and-ratchet mechanism whereby when the tumbler is disengaged the second shaft will be driven at a relatively low speed, and when the tumbler is in engagement the speed-reducing mechanism will be thrown out of commission, substantially as described.

3. In a variable-speed device, a tumbler-shaft, a tumbler-lever sliding and rocking thereon, a pinion and tumbler-gear carried by the tumbler-lever on said shaft, an intermediate shaft having a series of eccentric bearings of different diameter, the peripheries of said bearings being flush at a given point, different-diameter gear-wheels journaled on said eccentric bearings with their teeth flush under the tumbling-gear, a third shaft, a series of gear-wheels of different diameter thereon intermeshed respectively with the different-diameter gear-wheels on the intermediate shaft, and means actuated by the change of speed of the driven shaft due to the disengagement of the tumbler-gear for imparting a relatively slow rotation to said third shaft, substantially as described.

4. In a variable-speed device, a tumbler-shaft, a tumbler-lever sliding and rocking thereon, a pinion and tumbler-gear carried by the said lever on said shaft, an intermediate shaft having a series of eccentric bearings of different diameter flush opposite the tumbling-gear, gear-wheels journaled on said bearings respectively, presenting a flush peripheral surface of teeth under the tumbler-gear, a third shaft, a series of different-diameter gear-wheels thereon intermeshed with the gear-wheels on the intermediate shaft, a casing containing said parts and provided with a slot, the lower wall of which is substantially parallel with the direction of the tumbler movement, said tumbler-lever extending through and resting upon the said wall when the tumbler-gear is in engagement, substantially as described.

5. In a variable-speed device, a driving and a driven shaft, a variable-speed mechanism on and between said shafts, a driving-pinion fixed on the driving-shaft, an intermeshing gear-wheel of larger diameter loose on the driven shaft, a pawl-and-ratchet mechanism for connecting said loose gear to the driven shaft, and means actuated by the speed of the gear-wheels on the driven shaft to automatically engage and disengage said pawl-and-ratchet mechanism, substantially as described.

6. In a variable-speed device, a driving and a driven shaft, a variable-speed mechanism on and between said shafts, a driving-pinion fixed on the driving-shaft, an intermeshing gear-wheel loose on the driven shaft, a ratchet-wheel fixed to the driven shaft, a coöperating pawl fixed to said gear-wheel, a slotted collar loose on the driven shaft, and a stem one end of which is attached to the pawl and the other end engages in the said slot of the collar, substantially as described.

7. In a variable-speed device, a driving and a driven shaft, a variable-speed mechanism on and between said shafts, a driving-pinion fixed on the driving-shaft, a ratchet-wheel having a projected hub fixed upon said driven shaft, a gear-wheel loosely journaled on said hub and intermeshed with said driving-pinion, a slotted collar loose on the driven shaft, and a stem one end of which is fixed to the pawl and the other end of which lies within the slot of said collar, whereby the pawl is held out of engagement with the ratchet-teeth during higher speeds of the driven shaft and held in engagement during lower speeds, as and for the purposes specified.

8. In a variable-speed device, a bearing-shaft having a series of eccentric bearings of different diameter, said bearings having their peripheries flush upon one side, gear-wheels journaled on said bearings, a second shaft having a series of concentrically-mounted gear-wheels of different diameter intermeshed respectively with the first-named series of gear-wheels, a shifting gear-wheel, and means for intermeshing said gear-wheel with the flush side of the first-named series of gear-wheels on the first-named shaft, substantially as described.

9. In a variable-speed device, a shaft, a series of gear-wheels of different diameter concentrically mounted thereon, an intermeshing series of gear-wheels of different diameter having their peripheries flush upon one side, and bearings for said second series of gear-wheels arranged with their axes non-coincident, substantially as described.

10. In a variable-speed device, a shaft, a series of gear-wheels of different diameter concentrically mounted thereon, an intermeshing series of gear-wheels of different diameter having their peripheries flush upon one side, bearings for said second series of gear-wheels arranged with their axes non-coincident, a shifting gear-wheel and means for engaging the said gear-wheel into said flush peripheries of said series of gear-wheels, substantially as described.

11. In a variable-speed device, a tumbler-shaft, a tumbler-lever, a pinion and tumbling-gear carried by said lever and rocking and sliding on said shaft, a second shaft, different-diameter gear-wheels adapted to be engaged by the tumbler gear-wheel, an intermeshing set of gear-wheels on the second shaft, a gear-wheel on the tumbler-shaft, an intermeshing gear-wheel loose on the second shaft, pawl-and-ratchet mechanism for connecting said loose gear-wheel to the second shaft, and means actuated by the changes of speed of the second shaft to engage and dis-

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engage said pawl-and-ratchet mechanism whereby when the tumbler is disengaged the second shaft will be driven at a relatively low speed, and when the tumbler is in engagement the speed-reducing mechanism will be thrown out of commission, substantially as described.

In testimony whereof I have hereunto set my hand.

HENRY McCOY NORRIS.

Witnesses:
OLIVER B. KAISER,
LUISE BECK.